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# SURFACE CATCHES OF MARINE DIATOMS AND DINOFLAGELLATES OFF THE COAST OF OREGON BY U.S.S. "GUIDE" IN 1924

BY  
RALPH LEWIS

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## INTRODUCTION

In connection with the coastal survey work of the United States Coast and Geodetic Survey Steamer "Guide" near Cape Blanco, Cape Arago, and Port Orford during the months from July to November, 1924, there were obtained for the Scripps Institution one hundred and five surface samples of microplankton. These were collected according to the standard method established by the Scripps Institution (Allen, 1921), i.e., dipping a measured quantity of water from the surface of the ocean and filtering it through a filtration net of No. 25 (average diameter of openings about .05 mm.) bolting silk. This paper reports the results of a simple quantitative examination of the series.

The work was carried on in the general vicinity of Cape Blanco, but due to the extent of the territory covered and to the difference of the time of sampling it seemed advisable to group the samples according to more restricted regions. In this manner a comparison of the fluctuations of the production of the diatoms and dinoflagellates for the different regions is made possible.



There were six regions (fig. 1) to which the one hundred and five samples could be satisfactorily assigned. The first was the Coos Bay region, in which sixteen samples were taken between the head of the bay and the entrance, and several others just south of Cape Arago as far as  $43^{\circ} 15' N$  and extending offshore to  $124^{\circ} 28' W$ . The second is the Coquille Point region, extending from  $43^{\circ} 15' N$  to  $43^{\circ} 05' N$  and as far offshore as  $124^{\circ} 33' W$ . In this section eleven samples

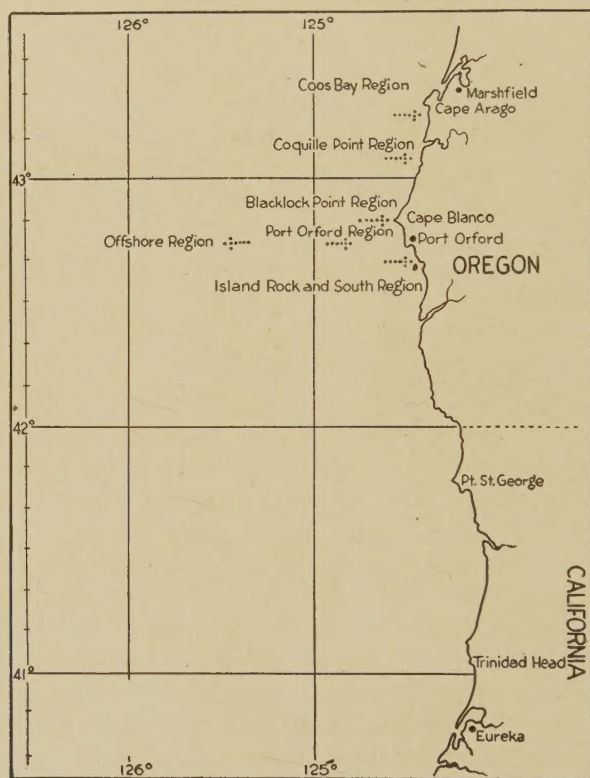


Fig. 1. Map of Cape Blanco territory. Local regions indicated by dotted signs.

were taken. The third region is to the north of Cape Blanco with  $43^{\circ} N$ ,  $42^{\circ} 50' N$ , and  $125^{\circ} 10' W$  as its boundaries. Samples numbers 8, 10, 12 and 13 were obtained offshore as far as  $124^{\circ} 50' W$  to  $125^{\circ} 10' W$ . The others were close inshore, sample number 1 being the farthest west,  $124^{\circ} 38'$ . In all there were nineteen samples from this section. The fourth region extends from  $42^{\circ} 50' N$  to  $42^{\circ} 40' N$  and as far off-shore as  $124^{\circ} 50' W$ . From this region twenty-one samples were taken. Section five extended from  $124^{\circ} 50' W$  as far as  $125^{\circ} 27' W$  along the line of latitude  $42^{\circ} 44' N$ . Seventeen catches

were taken there. The last region includes the territory covered on the southbound trip to San Francisco, extending from 42° 40' N to 40° 00' N.

The production of diatoms is shown to be fairly heavy for this general territory, while that of the dinoflagellates is very light. I will discuss the production of diatoms for each region, then discuss the dinoflagellates only for the general territory.

## PRODUCTION: DIATOMS

### 1. COOS BAY REGION

The samples of this section were taken at irregular intervals over a considerable length of time, from the eleventh of September to the last of October. Samples numbers 16 to 21 were taken at the Port Dock at Marshfield, which is at the head of the bay. Numbers 3 to 5, 28, and 44 were taken from Empire City to the whistling buoy, at the entrance of the bay, and numbers 22, and 84 to 87 were taken near Cape Arago. The largest catch in the region yielded 687,529 cells per liter. Only two failed to show any diatoms. The first three samples collected showed the largest production. These were taken the middle of September. Later, during the first week of October, six samples were taken at Marshfield and the production was noticeably less. The last taken in Coos Bay were very light, as were those taken off Cape Arago.

Thirty-seven species were recorded. The most prominent species present was in a group termed *Biddulphia* sp. Next in prominence occurred *Asterionella japonica* Cl., *Chaetoceras curvisetum* Cl., *Chaetoceras debile* Cl., a group of small forms classed under *Chaetoceras* sp., and *Thalassiosira decipiens* Grun. Also present in noticeable quantities were *Chaetoceras decipiens* Cl., *Melosira borrieri* Grun., *Skeletonema costatum* Grev., and *Thalassiothrix nitzschoides* Grun.

### 2. COQUILLE POINT REGION

Of the eleven samples from this section all showed some diatoms. The first sample yielded the largest quantity—1,259,568 cells per liter. The group of samples taken later, during the second week of October, showed a very light production varying between 5,130 to 10,856 cells per liter. Of the last group, taken on the fourteenth of November, the largest catch yielded 135 cells per liter.

Thirty-two species were recorded, the most prominent being *Chaetoceras curvisetum* Cl. and *Chaetoceras debile* Cl. Next came a group of small forms included under the term *Chaetoceras* sp., *Nitzschia seriata* Cl., and *Thalassiosira decipiens* Grun.



## 3. BLACKLOCK POINT REGION

This section showed a fair production of diatoms during the month of September, which fell to a very light production the following month. The largest production was from a catch made on the eighteenth of September, which yielded 1,487,400 cells per liter.

Of the nineteen samples, all showed some diatoms. Thirty species were recorded, those most prominent being *Asterionella japonica* Cl., *Chaetoceras affine* Laud., *Chaetoceras curvisetum* Cl., and *Chaetoceras debile* Cl., together with several small forms grouped under *Chaetoceras* sp. Among the less prominent species were *Chaetoceras compressum* Cl., *Chaetoceras criophilum* Gran., *Chaetoceras decipiens* Cl., *Chaetoceras scolopendra* Cl., *Nitzschia seriata* Cl., and *Rhizosolenia stolterfothii* Perag.

## 4. PORT ORFORD REGION

Three of the twenty-seven samples of this group were taken near Port Orford. Samples numbers 2 and 11, taken early in September, show a light production of diatoms, ranging between 2,000 and 5,500 cells per liter. Sample number 31, taken about the first of October, showed a noticeable increase—342,742 cells per liter. Those samples taken offshore in the vicinity revealed a moderate production until the tenth of October, the production falling very low after that date.

The other samples indicated a production similar to that at Port Orford. The largest yield was 886,544 cells per liter, from a catch taken about seven miles offshore. The next sample, taken a short distance away, showed a drop in the production, accompanied by a general falling off in the succeeding samples, as the progress westward was continued. All the other samples were light.

The most prominent species present were *Chaetoceras curvisetum* Cl., several small forms grouped under *Chaetoceras* sp., and *Nitzschia seriata* Cl. Twenty species were recorded. Several species of *Chaetoceras* were present in very large numbers in five of the samples, constituting a large percentage of the total present.

## 5. OFFSHORE REGION

The seventeen samples in this group were all taken in regular succession on the journey offshore. Four samples failed to show any diatoms, while the largest number of cells was 1,242 per liter. There were only six species recorded. Several small forms grouped under *Chaetoceras* sp. and *Rhizosolenia* sp. included the species present.



## 6. SOUTHERLY REGION

Fifteen samples were taken, all in regular succession on the journey south. Two failed to show any diatoms, while the largest production was 1,026 cells per liter. The few specimens recorded were mostly assigned to *Chaetoceras* sp. and *Thalassiosira* sp.

## PRODUCTION: DINOFLAGELLATES

The production of dinoflagellates in this series was very light, and only a very few species were recorded. Fifty-seven samples failed to show any cells, and of the other forty-eight the largest number of cells recorded was 160 per liter. All specimens noted belong to species commonly observed in the eastern Pacific.

## CONCLUSION

During the five months in which the samples were collected there was a very noticeable fluctuation in the production of diatoms. From July to the tenth of October nearly every sample revealed at least a moderate production. Thirty-three samples were taken in that period and only seven yielded less than 10,000 cells per liter. Eleven catches yielded more than 100,000 cells per liter, and the largest catch was 1,487,400 cells per liter. But, beginning with sample number 34, which was taken on the tenth of October, the production only once reached as high as 10,000 cells per liter, most of the catches yielding far less.

Comparing the first four regions, up to sample number 44 (fig. 2), we find that from September 11 to 18 large catches were taken in the first three regions, while one of the two catches for the Port Orford region revealed a fair quantity, but not in comparison with the large catches of the aforementioned regions. The largest catches occurred on the same day and were separated by only a few miles. The largest catch of region 3 occurred two days later. From October 4 to 10 there were several large catches in region 4 with small catches for the same period in the other three regions. The samples from the tenth to the twentieth were small excepting those taken in region 2, which yielded between 5,000 and 10,000 cells per liter, and the one sample of region 1 which yielded over 5,000 cells per liter. No more extensive comparison can be made as there were only a few samples taken on the same days for each section.

On comparing these results with those of former years, McEwen and Mortensen in 1920 (Allen, 1922) and U.S.S. "Pioneer," 1923 (Allen, 1924), a considerable disparity appears. Each of these earlier series indicates a very light yield of diatoms for the Cape Blanco region, and a very good yield for the Cape Mendocino region. The

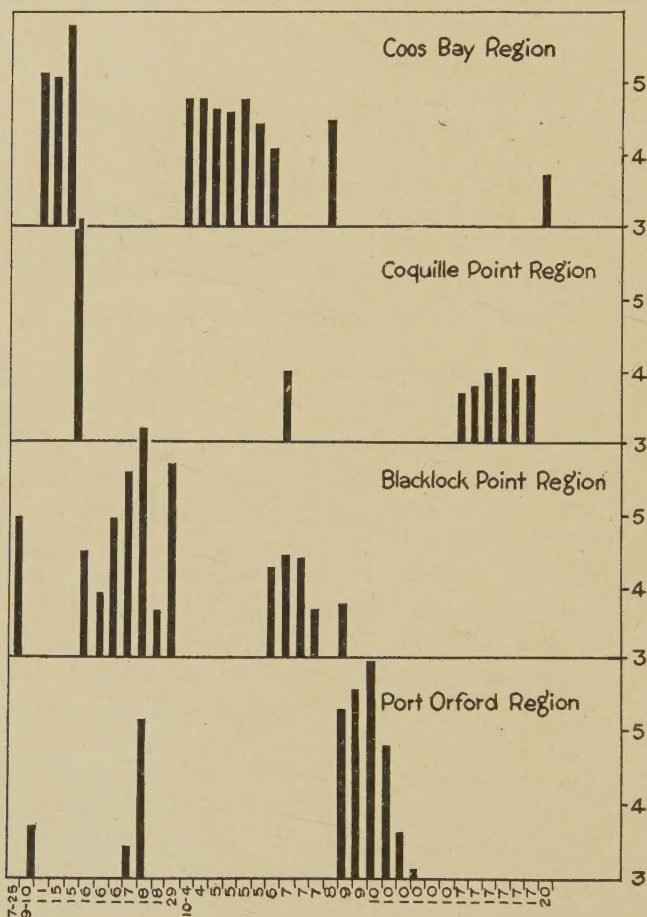


Fig. 2. Graphs to show logarithms of numbers of diatoms per liter.

results given in this paper are just the reverse of this; Cape Blanco region indicated a very good production and a very light yield was shown in the Cape Mendocino region. On comparing the prominent species and genera, they are found to be similar. Those genera occurring in common were, *Chaetoceras* (most prominent), *Asterionella*, *Nitzschia*, *Skeletonema*, *Thalassiosira*, and *Thalassiothrix*.



TEMPERATURE

It is interesting to note the relation of the production of the diatoms to the temperature of the ocean surface (see fig. 3). It is readily observed that the largest catches were generally taken from

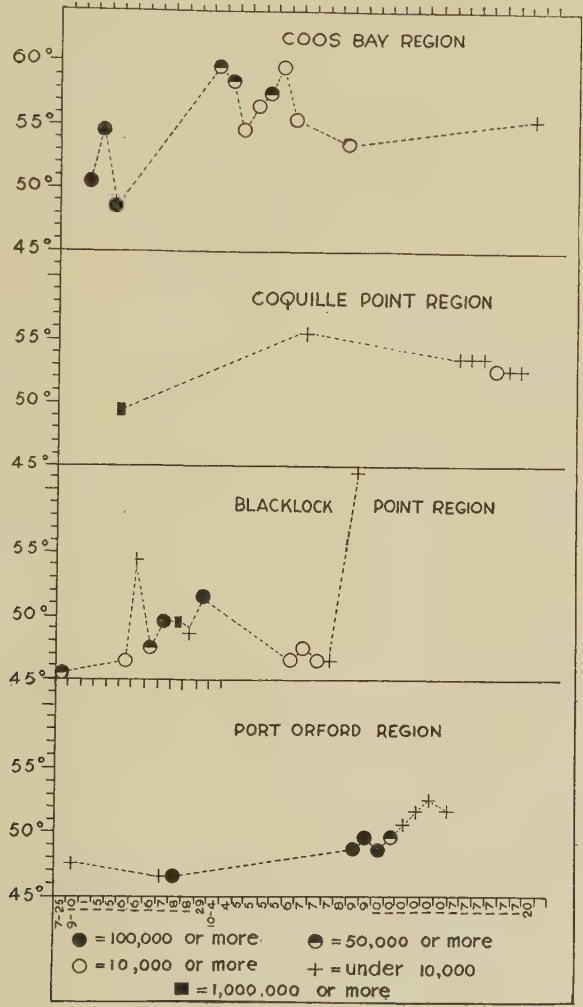


Fig. 3. Graph to show number of diatom cells to the liter in four regions.

the colder water, and the lighter catches from the warmer water. The fact that, in the first region, some of the heavier catches were taken in warmer water is to be accounted for by the presence there of a shallow bay extending several miles inland.

Using a medium temperature, such as  $52^{\circ}$ , as a line of demarcation for the first forty-four catches it is found that: (a) there were two catches with 1,000,000 or more cells per liter, in temperatures under  $52^{\circ}$ ; (b) of catches producing 100,000 cells per liter or more, there were eight in temperatures  $52^{\circ}$  and under, and only one over; (c) of those producing 50,000 cells per liter or more there were three under and three over; (d) of those producing 10,000 cells per liter or more there were four under and six over; and (e) of those producing less than 10,000 cells per liter there were eight in temperatures  $52^{\circ}$  or under, and nine, over. Examination of the other sixty-one samples of the series showed that in only two samples the temperature fell below  $52^{\circ}$ , being  $51^{\circ}$  in both cases. In the other samples the temperature ranged from  $52^{\circ}$  to  $57^{\circ}$ , none of the samples producing more than 1,000 cells per liter except two, with a slightly larger number.

The conclusion that can be drawn from the evidence shown in this series is that in the open sea the colder water is more favorable for the production of diatoms and that decrease in production accompanies rise in temperature. This does not exactly hold true in bays where warmer water is found, as is seen in this series. The explanation may be that the diatoms were brought in with the tide from the open sea, and were not truly the production of warmer water.

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